Analysis of Reverberation Chamber's Uniformity and Isotropy on Radiation Characteristics of Antenna

徐瑞鴻、邱政男 ; 林漢年

E-mail: 9706746@mail.dyu.edu.tw

ABSTRACT

In recent years, the electromagnetic compatibility (EMC) testing community is continually searching for more reliable, reproducible, and economical test techniques. Reverberation chamber (RC, also known as mode-stirred chamber) technique enjoys growing popularity as a complement or replacement to open area test site (OATS), (semi-) anechoic chambers (ACs), or transverse electromagnetic (TEM) cells for radiated interferences/susceptibility tests. A reverberation chamber is basically a metallic cavity containing several metallic stirrers. To excite a high intensity field in the cavity, we change the boundary conditions by continuously rotating metallic stirrers to break up the electromagnetic field distribution in specific space and generate enough numbers of effective resonance modes to produce a uniform and isotropic electromagnetic environment. The purpose of RC is to achieve statistically uniform, isotropic, and randomly polarized electromagnetic test environment inside the testing volume. When electronic devices under test have complex radiation patterns, RC tests are expected to produce more accurate and rigorous measurement results than the traditional OATS or (semi-) AC testing methods. In this thesis, we will first check the dimensions of useful test volume. We then use the transmitting/receiving antennas with known characteristics to investigate the effect of randomly polarized electromagnetic test environment on radiation characteristics of antennas inside the testing volume and the uniformity and isotropy of the test zone. A comparison between numerical simulation results and experimental measurements were analyzed and discussed.

Keywords : Reverberation Chamber ; Radiated Interference/Susceptibility Tests ; Isotropy ; Field Uniformity

Table of Contents

REFERENCES

[1] Teng-Yi Zou, Da-Yeh University, Taiwan, “ Effect of Rotational Stirrer Location on Field Uniformity inside Reverberation Chamber ”.

[2] Yin-Ru Huang, Da-Yeh University, Taiwan, “ Effect of Rotational Stirrer Shape on Field Uniformity inside a Reverberation Chamber ”.

[3] C. J. Ko, Da-Yeh University, Taiwan, “ Analysis of Field Uniformity and Isotropicity inside a Reverberation Chamber. ” .
[4] Po-Hsun Huang, Da-Yeh University, Taiwan, “ Effect of Radiation Source Location on Field Uniformity and Isotropicity inside Reverberation Chamber ” .
[5] IEC International 61000-4-21 Standard, “ Electro-magnetic compatibility (EMC)-part 4-21: Testing and measurement techniques-Reverberation chambers test methods ” ,1995.
[6] IEC 61726 – cable Assemblies, Cables, Connectors and passive Microwave Components – Screening Attenuation Measurement by the Reverberation Chamber Method, International Electrotechnical Commission (IEC), Geneva, Switzerland Int. Std., IEC SC 46A, Nov. 1999 [7] Lehman, Th. A statistical theory of electromagnetic fields in complex cavities. Note 494, USAF Phillips Laboratory Interaction Note Series, May 1993.
[8] Katsushige HARIMA, Yukio YAMANAKA, “ Evaluation of Electric-Field Uniformity in a Reverberation Chamber for Radiated Immunity Testing. ” , IEICE Trans. Commun., VOL.E84-B, NO.9, pp.2618-2621, September 2001.
[9] Arnaut, Lr. Compound exponential distributions for undermoded reverberation chambers. Accepted for publication in IEEE Trans. EMC (2002).
[10] David M. Pozar, Microwave Engineering 2nd ed., John Wiley & Sons, 1998, ISBN 0-471-17096-8.
[11] Liu, B.H., Chang, D.C., Ma, M.T.: Eigenmodes and the Composite Quality Factor of a Reverberating Chamber, NBS Technical Note 1066, National Bureau of Standards, Boulder, CO., August 1983.
[12] Per-Simon Kildal, Yngve Hamnerius, “ Accurate Measurement of Small Antennas and Radiation form Mobile Phones in Small Reverberation Chambers ” .
[13] X.C. Wei., Er-Ping Li , “ Transmitting Antenna's Reflected Power and its Influence on Reverberation Chamber Calibration ” , Electromagnetic Compatibility, IEEE Transactions on Volume 49, Issue 1, Feb. 2007 Page(s):192 - 194 [14] Christian Bruns, Ruediger Vahldieck , “ A Closer Look at Reverberation Chambers-3D simulation and Experimental Verification ” , Electromagnetic Compatibility, IEEE Transactions on Volume 47, Issue 3, Aug. 2005 Page(s):612 - 626 [15] Alyse Coates, Alistair P. Duffy , “ Maximum Working Volume and Minimum Working Frequency Tradeoff in a Reverberation Chamber ” , Electromagnetic Compatibility, IEEE Transactions on Volume 49, Issue 3, Aug. 2007 Page(s):719 - 722 [16] Niklas Wellander, Olof Lunden, and Mats Backstrom “ Experimental Investigation and Mathematical Modeling of Design Parameters for Efficient Stirrers in Mode-Stirred Reverberation Chambers ” , Electromagnetic Compatibility, IEEE Transactions on Volume 49, Issue 1, Feb. 2007 Page(s):94 - 103 [17] Jinliang He, Zhiyong Yuan, Rong Zeng, Fan Wu, “ Evaluation of Test Reproducibility of Calibration in Reverberation Chamber ” Electromagnetic Compatibility, 2007. EMC 2007. IEEE International Symposium on 9-13 July 2007 Page(s):1 – 4
[18] Zhiyong Yuan, Shuiming Chen, Jinliang He, Rong Zeng, and Tun Li, “ Evaluation of Transmit Antenna Position in Reverberation Chamber ” , Electromagnetic Compatibility, IEEE Transactions on Volume 49, Issue 1, Feb. 2007 Page(s):86 - 93